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Mark Scheme (Results)

June 2014

International GCE Chemistry (6CH02/01R)

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Summer 2014
Publications Code US038315*

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:

- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Section A (multiple choice)

Question Number	Correct Answer	Reject	Mark
1(a)	D		1

Question Number	Correct Answer	Reject	Mark
1(b)	B		1

Question Number	Correct Answer	Reject	Mark
2	B		1

Question Number	Correct Answer	Reject	Mark
3(a)	D		1

Question Number	Correct Answer	Reject	Mark
3 (b)	D		1

Question Number	Correct Answer	Reject	Mark
4	B		1

Question Number	Correct Answer	Reject	Mark
5(a)	D		1

Question Number	Correct Answer	Reject	Mark
5(b)	C		1

Question Number	Correct Answer	Reject	Mark
6	A		1

Question Number	Correct Answer	Reject	Mark
7	D		1

Question Number	Correct Answer	Reject	Mark
8	B		1

Question Number	Correct Answer	Reject	Mark
9	C		1

Question Number	Correct Answer	Reject	Mark
10	C		1

Question Number	Correct Answer	Reject	Mark
11	B		1

Question Number	Correct Answer	Reject	Mark
12(a)	A		1

Question Number	Correct Answer	Reject	Mark
12(b)	C		1

Question Number	Correct Answer	Reject	Mark
13	A		1

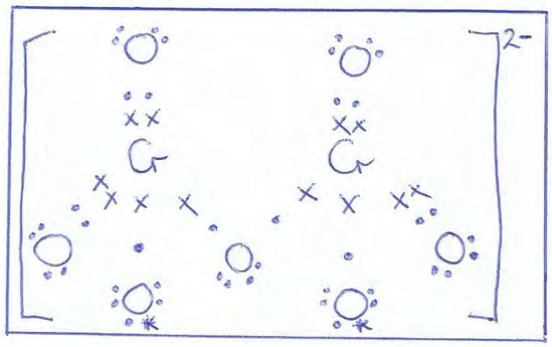
Question Number	Correct Answer	Reject	Mark
14	B		1

Question Number	Correct Answer	Reject	Mark
15	D		1

Question Number	Correct Answer	Reject	Mark
16	C		1

TOTAL FOR SECTION A = 20 MARKS

Section B

Question Number	Acceptable Answers	Reject	Mark
17 (a)	 The correct number of dots and crosses around both chromium atoms **(1)** All the oxygen atoms to have the correct number of bonds and the lone pairs **(1)** The extra 2 electrons from the potassium on the oxygen(s) **(1)**	Both * on the same oxygen	3

Question Number	Acceptable Answers	Reject	Mark
17 (b)(i)	(n=14.71 ÷ 294.2 =) 0.0500 (mol) **(1)** (c= 0.0500 ÷ 0.25 =) 0.200 (mol dm^{-3}) **(1)** Allow TE on incorrect M_r value Allow use of 294 Correct answer without working scores (2) Allow 1SF If units are given then they must be correct		2

Question Number	Acceptable Answers	Reject	Mark
17 (b)(ii)	(0.00250 x 6 =) 0.0150 (mol) (0.0150 x 166 = 2.49 (g)) **(1)** 2.6 ≤ value ≤ 5.0 (g) **(1)** TE for suitable mass to use on incorrect calculation Suitable mass must be between 0.10 g more than the calculated value but less than or equal to double the calculated value Allow 1 SF for the suitable mass		2

Question Number	Acceptable Answers	Reject	Mark
17 (b)(iii)	(0.00260 x 2 =) 0.00520 (mol) **(1)** (V=0.00520 ÷ 0.16 x 1000 =) 32.5 (cm^3) / 0.0325 **dm^3** **(1)** Allow answer without working **(2)** Volume must be at least 3 SF		2

Question Number	Acceptable Answers	Reject	Mark
17 (b)(iv)	Percentage error large with a small mass/ Mass is only to 1 SF **(1)** No repeats possible **(1)**	Just 'mass is not accurate' Reference to concentration.	2

Question Number	Acceptable Answers	Reject	Mark
17 (c)(i)	$Cl^- \rightarrow \frac{1}{2}Cl_2 + e^{(-)}$ OR $Cl^- - e^{(-)} \rightarrow \frac{1}{2}Cl_2$ Ignore state symbols even if wrong Allow multiples Allow $2HCl \rightarrow Cl_2 + 2e^{(-)} + 2H^+$	Reverse equation Iodide equation	1

Question Number	Acceptable Answers	Reject	Mark
17 (c)(ii)	(Gas X) Ammonia / NH_3 Allow ammonia (solution) / NH_3 (aq) **(1)** (Observation) White smoke / solid ALLOW Dense white fumes/white cloud **(1)** The observation mark is consequential on the Gas X being correct or a near-miss If name and formula given then both must be correct	 Misty fumes/ White gas/ White ppt/ Steamy fumes	2

Question Number	Acceptable Answers	Reject	Mark
17 (d)	Cream ppt / solid ALLOW Off white / pale yellow **(1)** Cream ppt/AgBr remains in dilute NH_3 but dissolves in conc. NH_3 **(1)** AgCl dissolves in both dilute and conc. NH_3 **(1)**	Just yellow/ Just white Just bromide ions	3

TOTAL FOR Q17 = 17 MARKS

Question Number	Acceptable Answers	Reject	Mark
18 (a)	The outer electrons are closer to the nucleus/smaller atomic radius/ less electron shells (in calcium) **(1)** Less shielding (in calcium) **(1)** OR Reverse argument for strontium Ignore reference to repulsion between shells	Ionic radius/ Molecules Just 'less electrons'	2

Question Number	Acceptable Answers	Reject	Mark
18 (b)(i)	Nichrome wire / platinum wire / silica rods **(1)** (Dip / clean) in (concentrated) HCl/HCl(aq)/dilute HCl and place in Bunsen flame **(1)** OR Allow alternative procedures such as: Make a salt solution **(1)** Soak in wooden splint and place in Bunsen flame **(1)**	Nickel/Ni/ Chromium/Cr/ Metal loop/wire Yellow flame/burn	2

Question Number	Acceptable Answers	Reject	Mark
18 (b)(ii)	(Pale/Light) green / apple green	Blue-green	1

Question Number	Acceptable Answers	Reject	Mark
18 (b)(iii)	Electrons promoted to higher energy level **(1)** Electron(s) return to lower energy level **(1)** Release of (visible/ light) energy/ photon upon return **(1)**	 Proton	3

Question Number	Acceptable Answers	Reject	Mark
18 (c)(i)	Barium hydroxide / $Ba(OH)_2$ Allow product as part of the equation: $Ba + 2H_2O \rightarrow Ba(OH)_2 + H_2$		1

Question Number	Acceptable Answers	Reject	Mark
18 (c)(ii)	Bubbles / Fizzing / Effervescence IGNORE The Barium dissolves / forms a colourless solution Increase in temperature	The metal sinks Air bubbles Just 'a gas is produced'	1

Question Number	Acceptable Answers	Reject	Mark
18 (d)(i)	Barium is oxidized from 0 to +2 **(1)** Chlorine is reduced from 0 to -1 **(1)** Allow one mark if oxidized and reduced are the wrong way round Ignore reference to transfer of electron unless incorrect.		2

Question Number	Acceptable Answers	Reject	Mark
18 (d)(ii)	$Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$ One mark for chemical symbols **(1)** One mark for state symbols **(1)** Allow one mark maximum for: $BaCl_2(aq) + H_2SO_4(aq) \rightarrow BaSO_4(s) + 2HCl(aq)$ OR Ions not cancelled	 $BaSO_4(aq)$	2

Question Number	Acceptable Answers	Reject	Mark
18 (d)(iii)	To prevent formation of carbonate / sulfite / sulfate(IV) (precipitate) / to remove carbonate / sulfite / sulfate(IV) ions	Just 'to remove other ions'	1

Question Number	Acceptable Answers	Reject	Mark
18 (e)(i)	$MgCO_3 + 2HCl \rightarrow MgCl_2 + H_2O + CO_2$ Ignore state symbols even if incorrect ALLOW $MgCO_3 + 2HCl \rightarrow MgCl_2 + H_2CO_3$		1

Question Number	Acceptable Answers	Reject	Mark
18 (e)(ii)	**Marking Point 1** (Factor) Use larger lumps **(1)** **Marking Point 2** (Explanation) Decreases surface area OR Fewer **collisions** between the reactants **(1)** Alternatively **Marking Point 1** (Factor) Decreases surface area **(1)** **Marking Point 2** (Explanation) Fewer **collisions** between the reactants **(1)** --- **Marking Point 3** (Factor) Decrease concentration (of acid) **(1)** **Marking Point 4** (Explanation) Fewer **collisions** between the reactants OR Fewer particles for the same volume **(1)** Explanation marking point only awarded for correct factor or a near miss.	Just 'increased size of $MgCO_3$' Just 'change in volume of acid'	4

Question Number	Acceptable Answers	Reject	Mark
18 (f)	Pressure only affects gaseous reactions/ There is no significant volume change/the liquids are incompressible		1

TOTAL FOR Q18 = 21 MARKS
TOTAL FOR SECTION B = 38 MARKS

Section C

Question Number	Acceptable Answers	Reject	Mark
19 (a)	Tertiary **(1)** Part of the molecule which determines how it will react / atom (or group of atoms) responsible for its (chemical) properties **(1)**	Secondary/ Primary	**2**

Question Number	Acceptable Answers	Reject	Mark
19 (b)	$C_{10}H_{20}O_2$	$C_{10}H_{18}(OH)_2$	**1**

Question Number	Acceptable Answers	Reject	Mark
19 (c)(i)	Inert /unreactive /abrasive / breaks open (cell walls) Allow 'releases the oil'		**1**

Question Number	Acceptable Answers	Reject	Mark
19 (c)(ii)	London forces **(1)** Allow van der Waals'/dispersion forces / temporary-induced dipole forces Temporary / instantaneous dipoles due to movement of electrons **(1)** Induces dipoles (in adjacent molecules) **(1)** Any reference to permanent dipoles MP3 only can be awarded.		**3**

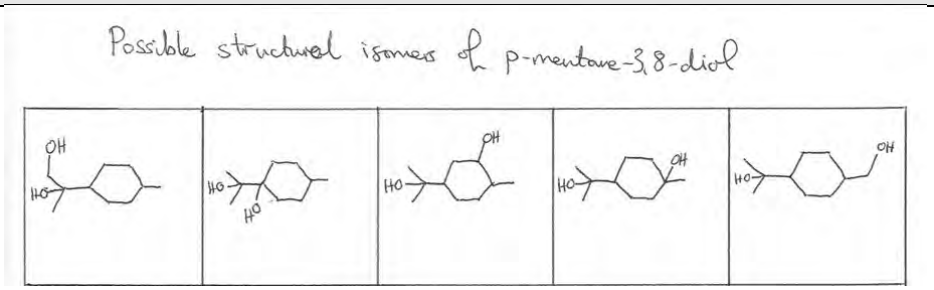
Question Number	Acceptable Answers	Reject	Mark
19 (c)(iii)	Filtration Allow **Centrifuge and** decant	Distillation Just decant	**1**

Question Number	Acceptable Answers	Reject	Mark
19 (c)(iv)	Drying agent/Removing water/absorb moisture	Dehydration	**1**

Question Number	Acceptable Answers	Reject	Mark
19 (c)(v)	The liquid / cyclohexane / *p*-menthane-3,8-diol evaporates **(1)** And then condenses and runs back into the flask / cannot escape **(1)** Allow 1 mark for reference to reflux if first two marks not awarded Set up apparatus for distillation Allow fractional/steam distillation **(1)** Collect / discard (the condensed) **cyclohexane** Allow diol remains in the flask/separate out the **cyclohexane** **(1)** Allow one mark simply for 'distillation'		**4**

Question Number	Acceptable Answers	Reject	Mark
19 (d)(i)	Absorption due to OH (stretch)/ Peak due to the OH ALLOW Alcohol/hydroxyl group	Reference to 'fingerprint region' Bond breaking OH^-	**1**

Question Number	Acceptable Answers	Reject	Mark
19 (d)(ii)	CH_3^+ **(1)** OH^+ **(1)** Allow CH_2^+ Penalise the lack of charge or incorrect charge once only		2

Question Number	Acceptable Answers	Reject	Mark
19 (e)	 Any two of the above structures The bond must clearly go to the O of the OH group but penalise once only		2

Question Number	Acceptable Answers	Reject	Mark
19 (f)	Any two from: Principle / Explanation Reduced depletion of non-renewable resources **(1)** — Use renewable resources **(1)** Reduced energy use / more efficient use of energy (to heat up) **(1)** — Use of catalysts **(1)**; Use of microwave energy **(1)** Less pollution **(1)** — Reduce hazardous waste / damage to environment **(1)** Less waste **(1)** — Improve atom economy **(1)**; Find use for any by-product **(1)** Ignore references to cost / greener/ recycling		4

TOTAL FOR SECTION C (Question 19) = 22 MARKS

TOTAL FOR PAPER = 80 Marks

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